

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 July 2002 (11.07.2002)

PCT

(10) International Publication Number
WO 02/053833 A1

(51) International Patent Classification⁷: **D21F 7/08**,
1/12, 7/10

(21) International Application Number: **PCT/FI01/01123**

(22) International Filing Date:
18 December 2001 (18.12.2001)

(25) Filing Language: **Finnish**

(26) Publication Language: **English**

(30) Priority Data:
20002772 18 December 2000 (18.12.2000) **FI**

(71) Applicant (for all designated States except US): **TAM-
FELT OYJ AB** [FI/FI]; Yrittäjänkatu 21, FIN-33710
Tampere (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HYVÖNEN, Kari**
[FI/FI]; Yrttikatu 8 A 1, FIN-33710 Tampere (FI). **RE-
HAKKA, Heikki** [FI/FI]; Tuumankatu 16, FIN-33270
Tampere (FI). **VIRTANEN, Tauno** [FI/FI]; Aaltosenkatu
31-33 B 15, FIN-33500 Tampere (FI).

(74) Agent: **KOLSTER OY AB**; Iso Roobertinkatu 23,
P.O.Box 148, FIN-00121 Helsinki (FI).

(81) Designated States (national): **AE, AG, AL, AM, AT, AT**
(utility model), **AU, AZ, BA, BB, BG, BR, BY, BZ, CA,**
CH, CN, CO, CR, CU, CZ, CZ (utility model), **DE, DE**
(utility model), **DK, DK** (utility model), **DM, DZ, EC, EE,**
EE (utility model), **ES, FI, FI** (utility model), **GB, GD, GE,**
GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,

KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK,
MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU,
SD, SE, SG, SI, SK, SK (utility model), **SL, TJ, TM, TN,**
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): **ARIPO** patent (**GH, GM,**
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (**AM, AZ, BY, KG, KZ, MD, RU, TJ, TM**),
European patent (**AT, BE, CH, CY, DE, DK, ES, FI, FR,**
GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), **OAPI** patent
(**BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,**
NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted
a patent (Rule 4.17(ii)) for the following designations **AE,**
AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,
CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES,
FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG,
MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU,
SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG,
UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (**GH, GM, KE, LS,**
MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), **Eurasian** patent
(**AM, AZ, BY, KG, KZ, MD, RU, TJ, TM**), **European** patent
(**AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU,**
MC, NL, PT, SE, TR), **OAPI** patent (**BF, BJ, CF, CG, CI,**
CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
— of inventorship (Rule 4.17(iv)) for US only

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: **PRESS FELT STRUCTURE AND METHOD OF MANUFACTURING PRESS FELT**

(57) Abstract: The invention relates to a method of manufacturing a press felt, a press felt and a base fabric. The press felt comprises a base fabric (2) with a batt fibre layer (1) attached on at least the surface facing a paper web. The base fabric is a laminate comprising at least two separate layers (4 to 6; 11, 12). For the base fabric, one or more base fabric modules (14 to 16) are provided, which are assembled with a butt seam into a closed loop. According to one preferred embodiment, at least two different connecting portions (22 to 24) of different lengths are provided at the jointing edge of the module from the different layers of the base fabric, which connecting portions are inverted relative to one another at the jointing edges to be interconnected and the layers from a lap joint at the seam area.



WO 02/053833 A1

PRESS FELT STRUCTURE AND METHOD OF MANUFACTURING PRESS FELT

FIELD OF THE INVENTION

[0001] The invention relates to a method of manufacturing a press felt, the method comprising forming a laminated base fabric having at least two
5 superimposed, independent, woven layers, each layer having its own warp yarns and weft yarns; assembling the base fabric from one or more base fabric modules into one closed loop; providing for assembly jointing edges at the opposing edges of the base fabric; and attaching at least one batt fibre layer to the base fabric after the assembly.

10 **[0002]** The invention further relates to a press felt, which comprises a woven base fabric and at least one batt fibre layer, and in which the base fabric comprises at least two superimposed, independent layers, each layer having its own warp yarns and weft yarns, the base fabric further comprising at least one base fabric module, which base fabric module is provided with nec-
15 essary jointing edges, of which jointing edges one or more base fabric modules are joined into a closed loop base fabric.

[0003] The invention also relates to a base fabric, which comprises at least two superimposed, independent layers, each layer having its own warp yarns and weft yarns, and which base fabric comprises at least one base fabric
20 module which is provided with necessary jointing edges, of which jointing edges one or more base fabric modules are joined into a closed loop base fabric.

BACKGROUND OF THE INVENTION

[0004] The aim of a press section in a paper machine is to drain a
25 web as efficiently as possible without causing any deterioration in the quality of the web, however. From the viewpoint of energy consumption, it is most advantageous to remove as much water as possible already at the press section, whereby there is less need to dry the paper web at subsequent sections of the paper machine. Depending on the press structure, the press section of the
30 per machine employs a press felt on one or both sides of the web to be dried, into which press felt the water in the web is absorbed. The purpose of the press felt is to transport the water away after pressing without allowing it to migrate back into the web. In pressing, the paper web is conveyed on the felt to a gap between two rolls, i.e. so-called nip. Typically, there are one to four nips in
35 succession, and in each nip water is pressed out of the web into the felt. Con-

sequently, the felt should be such that the water can well be absorbed into the felt pressed in the roll nip. The press felts comprise a base fabric that provides the felt with a necessary space for water, for instance. To make the felt surface smooth, batt fibre is needled onto a base fabric surface facing the paper web.

- 5 The batt fibre thus prevents markings from being produced on the web to be drained. In addition, by means of the batt fibre the water retention capacity of the felt can be adjusted to a desired level such that water is prevented from migrating back from the felt into the web, i.e. so-called rewetting is prevented. Further, the press felt should endure pressing, in order not be permanently
10 compressed, and thereafter, easily blocked.

- [0005] Even though non-woven arrays of yarns and corresponding structures have also been developed, the base fabric of the press felt is still typically manufactured by weaving, because better stability is achieved by a woven structure. Further, weaving allows better formation of a base fabric to
15 suit each purpose, because there are more structural alternatives. Several alternative ways to weave the base fabric are known. The base fabric can be woven on a weaving machine directly into an endless loop. In that case, the weft yarns, transversal while being woven, are in the machine direction during use on the paper machine, whereby the width of the weaving machine limits
20 the length of the base fabric to be manufactured. Using this technique, it is difficult to manufacture sufficiently long base fabrics for all press types. Further, it is possible to weave base fabrics provided with seam loops, and a necessary number of the base fabrics can be connected to form a closed loop. The seam loops at the ends of the base fabrics to be connected are intermeshed and en-
25 gaged by inserting a seam yarn in a channel formed by the seam loops. The base fabric with seam loops can be woven by the known methods as flat weaving or horseshoe weaving. When woven as a plane, the weft yarns form seam loops on both edges of the fabric. Horseshoe weaving, in turn is carried out endless, so that only one edge of the fabric is provided with seam loops
30 formed by weft yarns. Thus the base fabric can be assembled from a plurality of flat, or correspondingly, horseshoe portions, which are interconnected at their ends to form one longer entity. The press felts with seam loops have a drawback that at the seam the base fabric is different from other portions, whereby the properties of the felt at the seam area are different. In addition,
35 the attachment of the batt fibre to the base fabric is difficult at the seam loop area, where yarn density is lower. During use, the felt is subjected to tensile

stress, because of which the seam area, in particular, tends to deform. This weakens the adherence of the batt fibre even further and affects the permeability properties of the seam area.

BRIEF DESCRIPTION OF THE INVENTION

5 **[0006]** The object of the present invention is to provide a novel and improved press felt for a paper machine, a base fabric and a method of manufacturing the press felt.

10 **[0007]** The method of the invention is characterized by arranging, in assembling the base fabric, prior to batt fibre attachment, transverse jointing edges of one or more base fabric modules edge on edge, substantially closely against one another, and connecting them at the resulting butt seam to form a closed loop.

15 **[0008]** Further, the press felt of the invention is characterized in that the base fabric modules to be connected are substantially as wide as the press felt and that, prior to attaching the batt fibre, the transverse jointing edges of the base fabric modules are arranged with a butt seam edge on edge, substantially closely against one another, to form a closed loop of a desired length.

20 **[0009]** Further still, the base fabric of the invention is characterized in that the base fabric modules to be connected are substantially as wide as the press felt and that the transverse jointing edges of one or more base fabric modules are arranged with a butt seam edge on edge, substantially closely against one another, and connected at the butt seam to form a closed loop of a desired length.

25 **[0010]** The basic idea of the invention is to form a base fabric having a laminated structure for the press felt, i.e. multi-layered base fabric having at least two superimposed, independent layers. Each of these independent layers comprises weft yarns and warp yarns of its own. According to the inventive idea, the base fabric is assembled of one or more base fabric modules to form a closed loop of a desired length. For assembly, at least one base fabric module edge, transverse to the paper machine direction, is provided with a jointing edge. On assembly, the jointing edges of one or more base fabric modules are interconnected with a butt seam. Each of the base fabric portions to be connected is substantially as wide as the press felt, i.e. seen in the lateral direction the press felt is continuous. Typically, one or more batt fibre layers
35 are attached to the base fabric, preferably by needling.

[0011] Thanks to the butt seam according to the invention, the properties in the seam area of the laminated base fabric now substantially correspond to those in the rest of the base fabric. Thus, the base fabric can be formed more freely than before of a plurality of different base fabric modules. It is possible to form the base fabric modules by different solutions, as regards the shape, the yarn material, the dimensions and the thread count, the weave, the number of superimposed laminated layers, etc., whereby different base fabrics can be customized for different press sections.

[0012] In general, the laminated felts have an advantage that it is easier to provide the laminated felts with a sufficient space for water, but nevertheless an even surface. Moreover, the laminated felts remain longer unclogged. The distribution of pressure is more even in the laminated felts, and consequently they are less liable to permanent compression. In the laminated felt the compression of the batt fibre is no longer so critical a factor as previously. Further, when the laminated felt is used, less vibration occurs in the press section, because variations in the felt thickness are smaller.

[0013] According to one preferred embodiment of the invention, one or more base fabric modules are interconnected by overlapping the connecting portions provided in their jointing edges. For said lap seam the first and the second jointing edges of the base fabric modules to be connected are provided with a seam area, where the independent layers of the module form at least two connecting portions of different lengths. The connecting portions of different lengths are in inverted positions in the first and the second edges to be connected such that, on assembly, the connecting portions of the first edge and the connecting portions of the second edge fit edge on edge against one another to form a butt seam. Thus, the connecting portions of the first and the second jointing edges are in an alternating order in the seam area, and therefore the butt seams between the connecting portions are at different points in the seam area in the plane of the base fabric. Thanks to the lap seam, the butt seam between the base fabric modules becomes sufficiently strong, and hence it resists well the loading, to which the felt is subjected when the machine is run. The needled batt fibre binds the overlapping connecting portions.

[0014] According to a second preferred embodiment, one or more separate base fabric modules are interconnected by means of a lap seam at their cross machine direction ends. Thus is obtained one continuous closed loop, which is longer than individual base fabric modules. The solution expe-

rites and facilitates the manufacture of press felts, because a base fabric preform can be woven in advance into a long mat, which will be cut to a desired size for a base fabric module. It is relatively easy and quick to provide the ends of the module with seam areas for assembly according to the invention.

- 5 **[0015]** The basic idea of a third preferred embodiment of the invention is that the base fabric of the press felt is woven in a plane form, whereby the weaving direction and the running direction of the fabric on the paper machine remain the same. Further, the base fabric comprises two or more superimposed, independent layers, which are woven simultaneously on the
- 10 same weaving machine, each independent layer comprising its own yarn system such that the layers can be detached, if desired, from one another to form separate components. Each independent layer may have the same or different weave with respect to the other layers, likewise the yarn density, material, cross section and dimensions can be the same or different in each
- 15 layer. During the weaving process of the base fabric the layers are bound together at desired intervals with a weft- or warp-oriented binding yarn system separate from the yarn systems of the layers. Alternatively, a necessary number of single weft or warp yarns of one or more independent layers may travel at predetermined intervals between two or more layers and thus bind the
- 20 independent fabric layers together in the desired manner. The base fabric preform can be woven directly into a module of a predetermined length, or the base fabric preform can be woven into a continuous strip, wherefrom the base fabric modules of desired length are cut. A seam area of various layers of the base fabric is provided at both transverse ends of the base fabric module. For
- 25 making a seam, the binding between the superimposed layers is released by cutting the yarns that bind the layers together and by removing said yarns from a predetermined portion at both ends of the base fabric. Thereafter the different layers are detached from one another for the length of the seam area. The detached superimposed layers are cut in a preplanned manner with
- 30 respect to one another into at least two connecting portions of different lengths. The opposing module ends are cut to be mirror images of one another. An advantage with the above-described solution is that the base fabric can be woven flat, which allows the use of a simpler weaving machine which is also faster than the weaving machines suitable for flat weaving. Flat weaving also
- 35 provides a better possibility to customize the structure of the base fabric, because it is not connected with the shuttle rotation of the weaving machine. Moreover, because the weaving direction and the running direction of the flat

the weaving direction and the running direction of the flat woven base fabric are the same, it is possible to utilize the advantages of the warp-dominating fabric. The warp yarns can be flattened, their number can be great, and the yarn interlacing can be selected such that the surface of the base fabric becomes even.

[0016] The basic idea of a fourth preferred embodiment of the invention is that the base fabric of the press felt comprises at least one first base fabric module ready-woven into a closed loop and at least one second base fabric of a planar shape. The first and the second base fabric modules comprise one or more layers and their weave and yarns are suitably selected. The first and the second base fabric modules are superimposed, and the transverse jointing edges of the second, planar base fabric module are interlinked with a butt seam. There can be a plurality of base fabric modules woven into a loop as well as flat-woven modules, and further, they can be arranged one on top of the other in a desired manner. An advantage with this base fabric structure is that the loop-woven base fabric module receives the machine direction loading, to which the base fabric is subjected. The flat woven base fabric modules, in turn, contribute to the properties of the base fabric surface, as well as to the water volume, density, etc. In addition, the planar module is easy to manufacture by flat weaving.

[0017] It should be noted that in the present application the butt seam refers to a transverse base fabric seam, in which two layers in the same plane are arranged edge on edge, and the jointing edges, transverse to the plane surface of the base fabric, are disposed substantially closely against one another without any seam loops or like securing means, whereby the seam area substantially corresponds to the structure in the rest of the base fabric.

BRIEF DESCRIPTION OF THE INVENTION

[0018] The invention will be described in greater detail with reference to the attached drawings, wherein

Figure 1 is a schematic view of a press felt according to the invention cut open in the direction of warp yarns;

Figures 2 to 4 are schematic views of base fabrics of the press felt according to the invention cut open in the direction of the warp yarns;

Figure 5 is a schematic view, seen in perspective, of a base fabric according to the invention;

Figure 6 is a schematic view, seen in perspective, of a structural alternative of a base fabric module end according to the invention;

Figures 7 to 9 are schematic views of lap seam formation according to the invention at transverse ends of the base fabric module; and

5 Figure 10a is a schematic view of the base fabric according to the invention, which is assembled of the base fabric modules of Figures 10b and 10c.

[0019] For clarity, the figures are highly simplified. Like reference numerals refer to like parts.

10 DETAILED DESCRIPTION OF THE INVENTION

[0020] Figure 1 shows a structure of a press felt according to the invention, cut open in the direction of warp yarns. The press felt comprises three interlinked layers, of which the topmost layer, i.e. the one facing the web, is a batt fibre layer 1. Beneath the batt fibre layer there is a base fabric 2 and in the
15 lowest position there is still one batt fibre layer 3. The web-side batt fibre 1 prevents markings, i.e. patterning resulting from the base fabric texture, from being produced on the surface of the paper web. Typically, the batt fibre layer consists of at least two thinner layers to be needled separately one on top of the other. On the top surface of the batt fibre layer there is, in general, finer
20 batt fibre and coarser batt fibre at the bottom. A batt fibre layer is not necessary at the bottom of the press felt. The base fabric 2 of the press felt is manufactured of warp yarns and weft yarns by weaving. In general, the base fabric has relatively loose texture in order to provide a sufficient space for water, and suitable openness. The laminated base fabric shown in the figure comprises
25 three superimposed independent layers 4, 5 and 6. Each layer comprises specific warp yarns 7 and weft yarns 8, which interlace in the desired manner. For clarity, the figures of the application only show a few yarns of the weave. The laminated base fabric can be manufactured as shown in Figure 15a such that two or more separate base fabric preforms are woven in separate steps, and
30 the resulting preforms are arranged one on top of the other and, if desired, stitched together, for instance, to form one piece. Alternatively, the laminate is produced in one step by weaving as in Figures 2 to 4.

[0021] Figure 2 shows a second base fabric 2 according to the invention. As in Figure 1, the base fabric comprises three independent superimposed layers 4, 5 and 6. This base fabric is woven on one weaving machine
35 and in one step, whereby manufacturing is fast. Each independent layer of the

base fabric comprises its own weft yarns 8 and warp yarns 7, whereby the layers are detachable without disintegrating their actual structure. As appears from Figures 1 and 2, the warp yarns and weft yarns of different layers may interlace differently or identically. Likewise, the yarn density, dimensions and material can be selected separately for each layer. During weaving, the layers 4, 5 and 6 are bound together with binding yarns that are independent of the yarn systems of the layers. Regarding the structure of a single layer, the binding yarns are extra yarns. The binding yarns interlace between the superimposed layers and bind the independent layers of the base fabric into a whole, i.e. into a base fabric preform, out of which the base fabric of desired dimensions can be made. In the figure, the layers are bound with weft direction binding yarns 9. After weaving, the base fabric preform can be treated with heat. Alternatively, the heat treatment can be performed on the modules made of the base fabric preforms or on the base fabric loop just before attaching the batt fibre.

[0022] The base fabric of Figure 3 comprises two independent superimposed layers 11 and 12, of which the lower one comprises two plies and the upper one comprises one ply. The independent layers are further bound together with warp direction binding yarns 10.

[0023] Figure 4 shows a base fabric, which comprises two superimposed layers 11 and 12. As appears from the figure, the upper layer 11 consists of yarns, whose dimensions differ substantially from those in the lower layer 12. In flat weaving, the ratio of the yarn cross sections can be as high as 10 to 1, for instance. Further, the upper layer comprises weft yarns 8 in one ply, whereas the lower layer is a two-ply weave with weft yarns 8 in two plies. The layers of the base fabric are now interlinked by means of single warp yarns 13 interlacing in accordance with the yarn system of the upper layer 11. A predetermined number of upper-layer warp yarns 13 are arranged to pass through the lower-layer weft yarns 8 at suitable intervals during weaving. Alternatively, it is also possible to use lower-layer yarns in the binding. The yarns interlacing between the layers can also be weft yarns.

[0024] Figure 5 shows a base fabric 2 in the form of a closed loop. The base fabric of the figure is formed by assembling three separate base fabric modules 14, 15 and 16 in a longitudinal direction A, on the extensions of one another, to form a sequence of three modules, whereafter the outermost ends of the sequence are interconnected. This results in a closed loop. Natu-

rally, the properties of the modules to be connected in sequence are identical. In some cases it is advantageous to form the base structure by using only one base fabric module and one transverse butt seam, whereby the base structure comprises the lowest possible number of discontinuities. When the base fabric
5 is assembled, the transverse B edges of the base fabric modules, which edges are designed in accordance with the invention, are arranged edge on edge against one another, whereby the portions formed of the different module layers will be interlocked at a seam area 17. Thereafter, the base fabric modules are interconnected at the seam area so that the handling of the base fabric be-
10 comes easier, and the necessary batt fibre layers can be attached to the base fabric, advantageously by needling. The connection of the base fabric modules at the seam area can be carried out, for instance, with suitable stitches, by ultrasound welding, gluing, melting or any other suitable manner, however, without any locking means belonging to the structure of the base fabric modules.
15 The connection should hold the ends of the base fabric modules immovably in place at least until the needling of the batt fibre is completed. The needling of the batt fibre, together with the above-mentioned pre-connection, gives the seam its final strength. On the other hand, batt fibre alone may be sufficient to lock the seam, whereby the preforms can also be interconnected with soluble
20 materials, for instance, by using a binding yarn or film made of a water soluble polymer, or a soluble glue. Because no shape-locking or other particular locking means are used, the properties in the seam area are substantially the same as in the rest of the felt.

[0025] Figure 6 shows a male end of the base fabric module consisting of three different layers, in which the intermediate layer 5 extends
25 longer than the outer layers 4 and 6 in the longitudinal direction A of the base fabric module. Correspondingly, at the opposite end of the preform, which is not shown, the outer layers extend longer than the intermediate layer. Of the base fabric modules formed in this manner it is possible to assemble an end-
30 less base fabric that is longer than the individual modules. The base fabric modules can be made according to a suitable dimensioning scale, whereby ready-made base fabric modules of various lengths can be assembled into base fabrics of various lengths.

[0026] The jointing edge shown in Figure 6 can be formed, for in-
35 stance, by offsetting two or more separately woven, independent base fabric layers in superimposition for a predetermined distance, whereby the trans-

verse, opposite edges of the laminate are provided with connecting portions of different lengths for the lap seam.

[0027] Figures 7 to 9 show a method of providing a jointing edge according to the invention at a transverse edge of the base fabric module and interconnecting two base fabric modules in the longitudinal direction A. By means of this jointing edge one or more modules can be connected with a butt seam to form a closed loop of a desired length. A base fabric preform consisting of three independent layers 4, 5 and 6 is woven on the weaving machine in one step. The base fabric is woven directly into a module of the desired length, or alternatively, a base fabric module of a suitable length is cut from a longer strip. Thereafter, a jointing edge is provided at the transverse ends of the module 14 by detaching the superimposed layers for a predetermined length at the module end. In the structure of the figure, the superimposed layers are interlinked by means of separate binding wefts 9, which are now cut at points indicated by a broken line and removed from the jointing edge section. Thereafter, the layers are cut such that at least two portions of different lengths are provided at the module end. In the solution of Figure 8, each module layer is cut to form a connecting portion of different length: the topmost connecting portion 22 is longest and the midmost connecting portion 23 is shortest. As appears from Figure 9, a second module end to be connected to the first end of Figure 8 is designed to be inverted: the topmost connecting portion is shortest and the midmost connecting portion is longest. When the ends of the module(s) are fitted against one another as in Figure 9, the connecting portions of different lengths in the different modules are interlocked and the butt seams 25 of the opposing portions in each layer are offset in the longitudinal direction of the module. Hence, the structure of the seam area 17 is substantially similar to the rest of the base fabric.

[0028] Figure 10a is a side view of yet another base fabric according to the invention. The base fabric 40 is made of a first base fabric module 41 woven into a closed loop and of a second base fabric module 42, which is planar in shape, as in Figure 10c. Advantageously, the flat-woven second base fabric module 42 is arranged on top of the first base fabric module 41 woven in horseshoe form, whereafter the transverse jointing edges 43 and 44 of the second base fabric module are interconnected with a butt seam 45. Thereafter, the seam is strengthened with a suitable pre-connection, such as stitches passing through the first and the second layers, ultrasound welding or by

means of a soluble film. The structure has an advantage that the first base fabric module 41 receives well the loads to which the felt is subjected when the machine is run, and consequently it is possible to influence the other properties of the base fabric, such as density and surface properties, by means of the

5 second base fabric module 42. The flat-woven second base fabric module 42 is easier to manufacture and it allows a wide variety of structures and properties. Unlike in Figure 10a, there can be a plurality of loop-woven and planar base fabric modules attached to form a laminated structure. Further, the base fabric modules can be superimposed in a desired manner, for instance, in the

10 following manner: one or more planar base fabric modules are arranged on both the upper surface side and the lower surface side of the entity consisting of one or more loop-like base fabric modules. It is also possible to superimpose alternately a desired number of planar base fabric modules and loop-like base fabric modules.

15 [0029] The drawings and the relating specification are only intended to illustrate the inventive idea. The details of the invention may vary within the scope of the claims.

CLAIMS

1. A method of manufacturing a press felt, the method comprising:
forming a laminated base fabric (2) having at least two superimposed, independent, woven layers (4, 5, 6; 11, 12), each layer having its own
5 warp yarns (7) and weft yarns (8);
assembling the base fabric (2) from one or more base fabric modules (14, 15, 16; 41, 42) into one closed loop;
providing for assembly jointing edges at the opposing edges of the base fabric module; and
10 attaching at least one batt fibre layer (1) to the base fabric (2) after the assembly,
characterized by arranging, when assembling the base fabric, prior to batt fibre attachment, transverse jointing edges (43, 44) of one or more base fabric modules edge on edge, substantially closely against one another, and connecting them at the resulting butt seam (25, 45) to form a closed
15 loop.
2. A method as claimed in claim 1, **characterized** by manufacturing at least one base fabric module, at a first jointing edge of which at least two connecting portions of different lengths (22, 23, 24) are formed of the
20 different layers of the base fabric, and by providing connecting portions at a second jointing edge to be inverted relative to the first jointing edge, and by arranging, on assembly, the opposing connecting portions of the first and the second jointing edges edge on edge against one another, whereby the connecting portions overlap and the butt seams (25) in the adjacent connecting
25 portions are offset in the planar direction of the base fabric module.
3. A method as claimed in claim 1 or 2, **characterized** by assembling the base fabric (2) of one base fabric module (14, 15, 16; 42).
4. A method as claimed in claim 2, **characterized** in that the manufacturing of the base fabric comprises the steps of:
30 weaving at least two superimposed, independent layers in a base fabric preform of a press felt in one step;
binding the superimposed layers together during weaving by means of yarns interlacing between the independent layers, separate from the independent layer structure;
35 forming, after weaving, a jointing edge by cutting and removing the yarns binding the independent layers from the area of the jointing edge;

detaching the independent layers of the base fabric from one another at the jointing edge; and

cutting the independent layers at the jointing edge into at least two connecting portions of different lengths for a lap seam.

5 5. A method as claimed in claim 4, **characterized** by binding the independent layers of the base fabric during weaving by means of warp- and/or weft-direction binding yarns (9, 10) separate from the yarn systems of the layers.

10 6. A method as claimed in claim 4 or 5, **characterized** by binding the independent layers of the base fabric during weaving with single yarns of at least one base fabric layer, which yarns run at predetermined intervals through the basic yarns of at least two different layers.

15 7. A method as claimed in any one of claims 1 to 6, **characterized** by interconnecting the jointing edges of the base fabric modules in the vicinity of the butt seam so that the jointing edges hold immovably in place with respect to one another in the planar direction of the base fabric at least until the needling of batt fibre.

20 8. A method as claimed in claim 1, **characterized** by weaving one or more base fabric modules (41) having the form of a closed loop;

weaving one or more planar base fabric modules (42);

arranging one or more planar base fabric modules (42) at least on one surface of the closed-loop base fabric module (41); and

25 connecting the transverse jointing edges of the planar base fabric modules (42) edge on edge and connecting them with a butt seam into a closed loop.

30 9. A press felt, which comprises a woven base fabric (2) and at least one batt fibre layer (1), and in which the base fabric comprises at least two superimposed, independent layers (4, 5, 6; 11; 12), each layer having its own warp yarns (7) and weft yarns (8), and further, which base fabric comprises at least one base fabric module (14, 15, 16; 42), said base fabric module being provided with necessary jointing edges, of which jointing edges one or more base fabric modules are joined into a closed-loop base fabric, **characterized** in that the base fabric modules (14, 15, 16; 42) to be connected are
35 substantially as wide as the press felt and that, prior to batt fibre attachment, the transverse jointing edges of the base fabric modules are arranged edge on

edge with a butt seam, substantially closely against one another, to form a closed loop of a desired length.

10. A press felt as claimed in claim 9, **characterized** in that at least two connecting portions (22, 23, 24) of different lengths are provided
5 from the independent layers of the base fabric at the first jointing edge to be connected, and correspondingly, at the second jointing edge to be connected there are inverted connecting portions, and that the first and the second connecting portions are arranged to overlap, and there is a butt seam (25) between the opposing connecting portions of the jointing edges.

10 11. A press felt as claimed in claim 9, **characterized** in that the independent layers of the base fabric module are woven in separate steps, and thereafter, superimposed.

12. A press felt as claimed in claim 9, **characterized** in that the independent layers of the base fabric module are woven in plane form, and
15 simultaneously on one weaving machine.

13. A press felt as claimed in claim 12, **characterized** in that the independent layers of the base fabric module are bound together during weaving with warp- and/or weft-direction binding yarns (9, 10) separate from the yarn systems of the independent layers.

20 14. A press felt as claimed in claim 12, **characterized** in that the independent layers of the base fabric module are bound together during weaving with single weft or warp yarns which belong to the yarn system of at least one independent layer and which are arranged to travel at predetermined intervals between the basic yarns of at least two independent layers.

25 15. A press felt as claimed in any one of the preceding claims 9 to 14, **characterized** in that the press felt comprises one base fabric module in the longitudinal direction (A) of the press felt, which module is connected at its transverse ends (B) into a closed loop.

30 16. A press felt as claimed in any one of the preceding claims 9 to 15, **characterized** in that the base fabric comprises superimposed at least one base fabric module (41) woven into a closed loop and at least one planar base fabric module (42), which planar base fabric module (42) is connected with a butt seam (45) into a closed loop.

35 17. A base fabric, which comprises at least two superimposed, independent layers (4, 5, 6; 11, 12), each layer having its own warp yarns (7) and weft yarns (8), and which base fabric comprises at least one base fabric mod-

ule (14, 15, 16; 42), which base fabric module is provided with necessary jointing edges, of which jointing edges one or more base fabric modules are connected into a closed-loop base fabric, **characterized** in that the base fabric modules (14, 15, 16; 42) to be connected are substantially as wide as
5 the press felt and that the transverse jointing edges of one or more base fabric modules are arranged with a butt seam edge on edge substantially closely against one another and connected at the butt seam into a closed loop of a desired length.

1/4

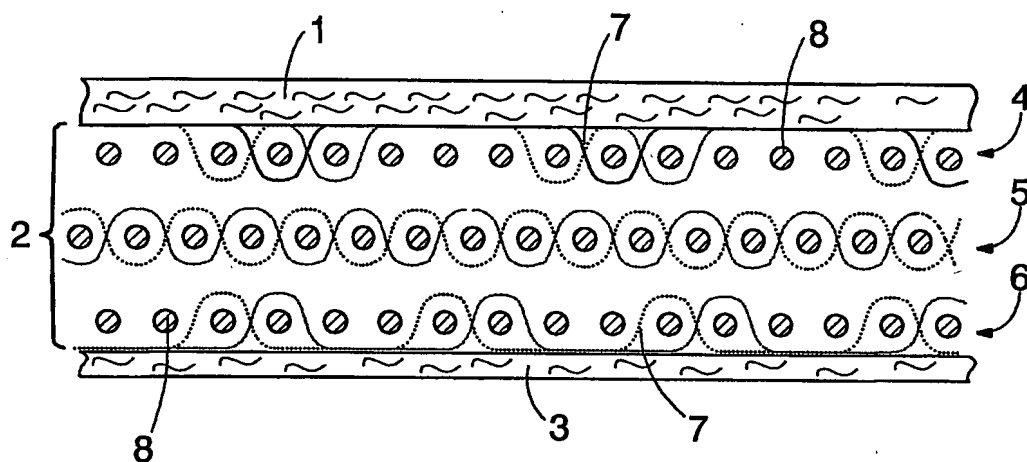


FIG. 1

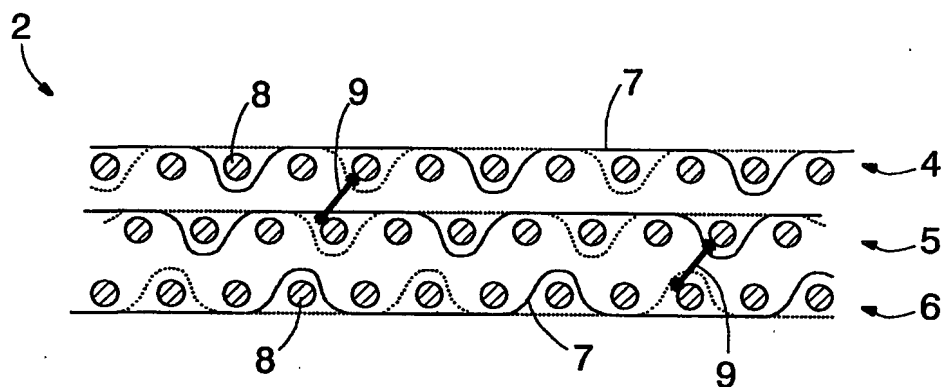


FIG. 2

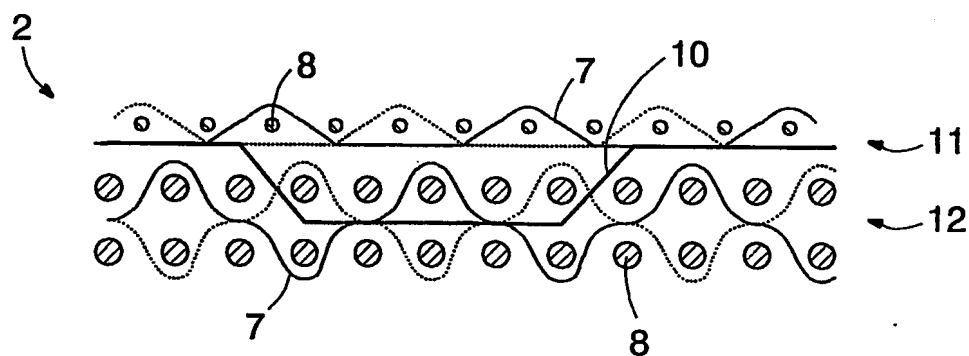


FIG. 3

2/4

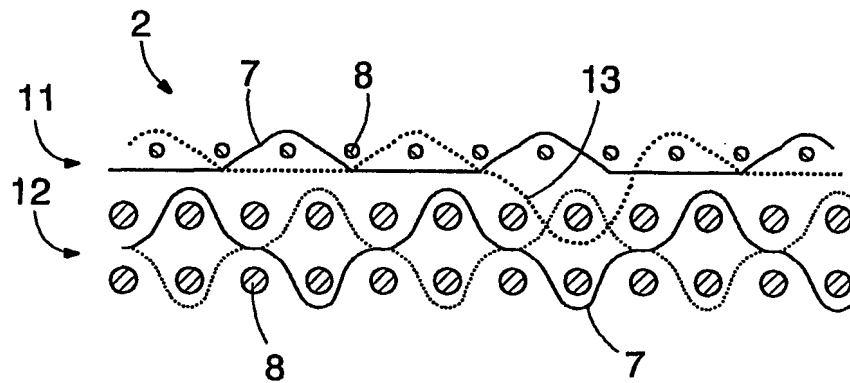


FIG. 4

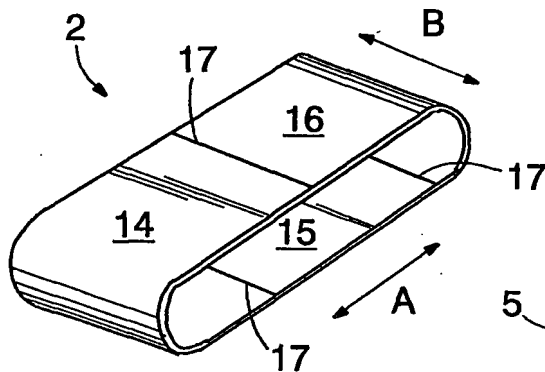


FIG. 5

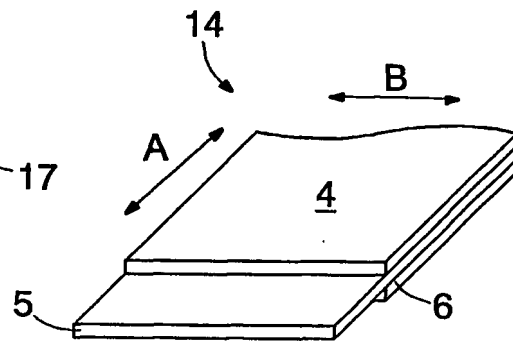


FIG. 6

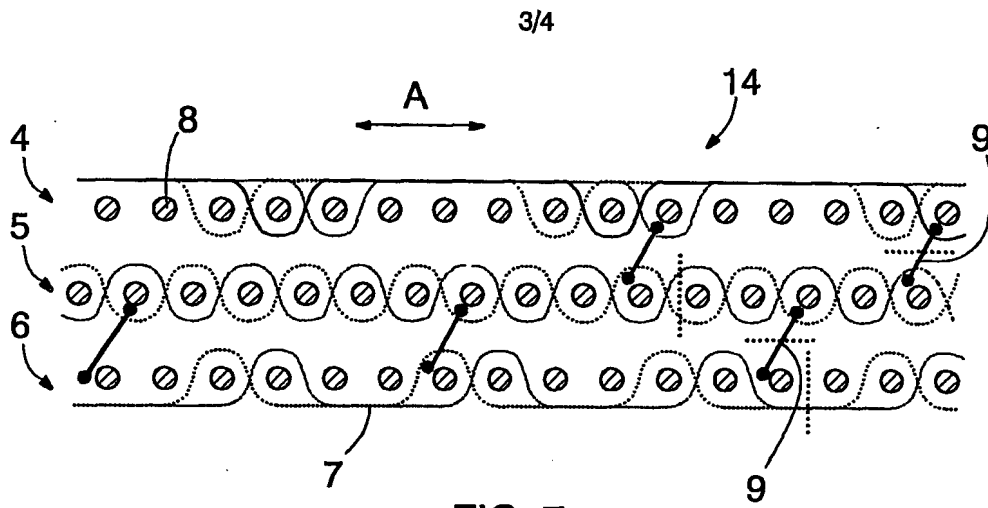


FIG. 7

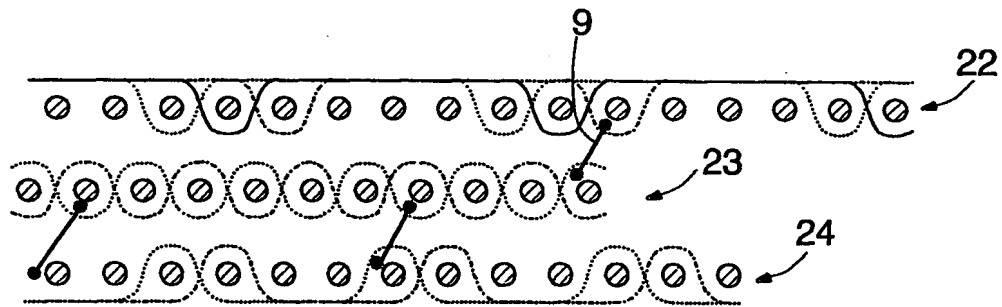


FIG. 8

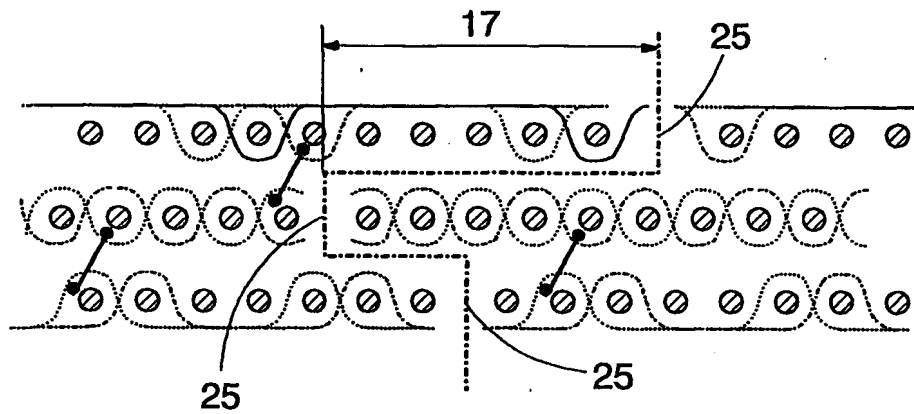


FIG. 9

4/4

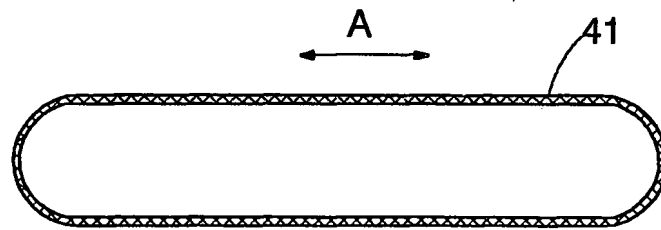


FIG. 10b

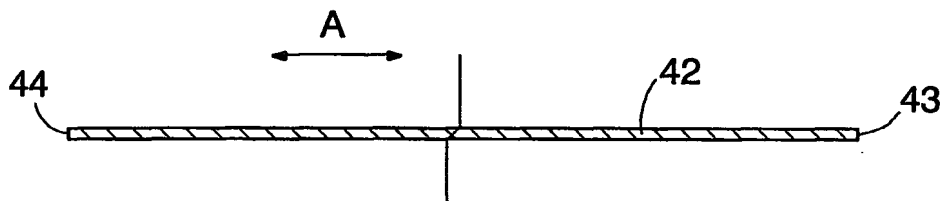


FIG. 10c

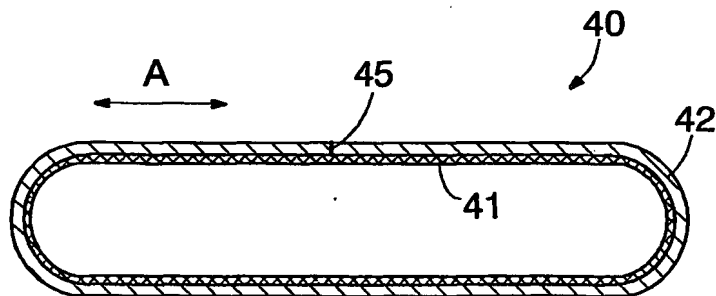


FIG. 10a

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/01123

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21F 7/08, D21F 1/12, D21F 7/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI DATA, EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0367614 A2 (SCAPA GROUP PLC), 9 May 1990 (09.05.90) --	1-17
Y	EP 0101202 A2 (THE WIGGINS TEAPE GROUP LIMITED), 22 February 1984 (22.02.84), page 7, line 3 - line 10, claim 4 (page 8) --	1-17
A	EP 0012519 A1 (ALBANY INTERNATIONAL CORP), 25 June 1980 (25.06.80), page 6, line 13 - line 16 --	6,14
A	US 4698250 A (TAUNO TALONEN ET AL), 6 October 1987 (06.10.87) --	1-17

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22 March 2002

Date of mailing of the international search report

26-03-2002

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Susanna Lindfors/MP
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/01123

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FI 80092 B (TAMFELT OY AB), 10 April 1990 (10.04.90) --	1-17
A	US 4090897 A (DAVID G. MINICK), 23 May 1978 (23.05.78) --	1-17
A	US 3393115 A (SIDNEY BEETHAM HAINSWORTH ET AL), 16 July 1968 (16.07.68) -- -----	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/01/02

International application No.

PCT/FI 01/01123

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
EP	0367614	A2	09/05/90	CA	2001994 A	04/05/90
				CN	1043916 A	18/07/90
				DK	549689 A	05/05/90
				GB	2225746 A	13/06/90
				GB	8825870 D	00/00/80
				GB	8924732 D	00/00/00
				JP	2242990 A	27/09/90
EP	0101202	A2	22/02/84	BR	8303855 A	28/02/84
				DK	331683 A	23/01/84
				FI	832630 A	23/01/84
				NO	832644 A	23/01/84
EP	0012519	A1	25/06/80	AR	218789 A	30/06/80
				AU	520026 B	07/01/82
				AU	5183179 A	19/06/80
				BR	7906669 A	14/10/80
				CA	1101255 A	19/05/81
				DE	2964751 D	00/00/00
				FI	62576 B,C	30/09/82
				FI	793882 A	16/06/80
				JP	1491050 C	07/04/89
				JP	55084472 A	25/06/80
				JP	63038467 B	29/07/88
				MX	149834 A	28/12/83
				NZ	191906 A	31/05/83
				SE	436901 B,C	28/01/85
				SE	7910098 A	16/06/80
				US	4186780 A	05/02/80
				ZA	7906527 A	31/12/80
US	4698250	A	06/10/87	CA	1274998 A	09/10/90
				DE	3637179 A	07/05/87
				FI	72767 B	31/03/87
				FI	854292 D	00/00/00
				SE	460293 B	25/09/89
				SE	8604659 A	02/05/87
FI	80092	B	10/04/90	FI	882480 D	00/00/00
US	4090897	A	23/05/78	NONE		
US	3393115	A	16/07/68	GB	989976 A	22/04/65